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Claims

[c1] 1. An article comprising:
a substrate formed of a metal alloy containing ruthenium above an amount that might be unintentionally present as an impurity; and
a coating system on a surface of the substrate, the coating system comprising an aluminum-containing bond coat on the surface of the substrate and a ceramic coating bonded to the substrate by the bond coat, the bond coat being substantially free of ruthenium except for ruthenium that has diffused into the bond coat from the substrate.

[c2] 2. The article according to claim 1, wherein the bond coat is a diffusion aluminide coating.

[c3] 3. The article according to claim 2, wherein the bond coat contains nickel aluminide and platinum aluminide intermetallics.

[c4] 4. The article according to claim 1, wherein the bond coat is an overlay coating consisting essentially of intermetallic phases.

[c5] 5. The article according to claim 4, wherein the bond coat contains, in atomic percent, about 30% to about 60% aluminum, optionally up to about 10% chromium, 0.1% to about 1.2% of at least one element chosen from the group consisting of zirconium, hafnium, silicon, and titanium, the balance being essentially nickel.

[c6] 6. The article according to claim 1, wherein the ceramic coating comprises yttria-stabilized zirconia.

[c7] 7. The article according to claim 1, wherein the ceramic coating has a columnar grain structure.

[c8] 8. The article according to claim 1, wherein the metal alloy of the substrate is a superalloy containing at least 0.4 weight percent ruthenium.

[c9] 9. The article according to claim 8, wherein the superalloy contains about 0.4 to about 6.5 weight percent ruthenium.

[c10] 10. The article according to claim 9, wherein the superalloy consists of, by weight, 0.4% to 6.5% ruthenium, 4.5% to 5.75% rhenium, 5.8% to 10.7% tantalum, 4.25% to 17.0% cobalt, up to 0.05% hafnium, up to 0.06% carbon, up to 0.01% boron, up to 0.02% yttrium, 0.9% to 2.0% molybdenum, 1.25% to 6.0% chromium, up to 1.0% niobium, 5.0% to 6.6% aluminum, up to 1.0% titanium,

3.0% to 7.5% tungsten, and wherein the sum of molybdenum plus chromium plus niobium is 2.15% to 9.0%, and wherein the sum of aluminum plus titanium plus tungsten is 8.0% to 15.1%, the balance nickel and incidental impurities.

[c11] 11. The article according to claim 8, wherein the superalloy contains at least one refractory metal selected from the group consisting of about 6.5 weight percent or more of tantalum, about 5 weight percent or more of tungsten, about 2 weight percent or more of molybdenum, about 3 weight percent or more of rhenium, and about 0.1 weight percent or more of hafnium.

[c12] 12. A gas turbine engine component formed of a nickel-base superalloy and having a coating system on a surface thereof, the nickel-base superalloy containing at least 0.4 weight percent ruthenium and at least one refractory metal selected from the group consisting of tantalum, tungsten, molybdenum, rhenium and hafnium, the coating system comprising an aluminide bond coat on the surface of the substrate and a ceramic coating bonded to the component by the bond coat, the bond coat being substantially free of ruthenium except for ruthenium that has diffused into the bond coat from the superalloy so that the bond coat has a higher ruthenium content adjacent the component than adjacent the ce-

ramic coating.

[c13] 13. The gas turbine engine component according to claim 12, wherein the bond coat is a diffusion aluminide coating containing nickel aluminide and platinum aluminide intermetallics.

[c14] 14. The gas turbine engine component according to claim 12, wherein the bond coat is an overlay coating consisting essentially of intermetallic phases and contains, in atomic percent, about 30% to about 60% aluminum, optionally up to about 10% chromium, 0.1% to about 1.2% of at least one element chosen from the group consisting of zirconium, hafnium, silicon, and titanium, the balance being essentially nickel.

[c15] 15. The gas turbine engine component according to claim 12, wherein the ceramic coating comprises yttria-stabilized zirconia and has a columnar grain structure.

[c16] 16. The gas turbine engine component according to claim 12, wherein the superalloy contains about 0.4 to about 6.5 weight percent ruthenium.

[c17] 17. The gas turbine engine component according to claim 12, wherein the superalloy contains at least one refractory metal selected from the group consisting of about 6.5 weight percent or more of tantalum, about 5

weight percent or more of tungsten, about 2 weight percent or more of molybdenum, about 3 weight percent or more of rhenium, and about 0.1 weight percent or more of hafnium.

[c18] 18. The gas turbine engine component according to claim 12, wherein the superalloy contains about 6.5 weight percent or more of tantalum, about 5 weight percent or more of tungsten, about 2 weight percent or more of molybdenum, about 3 weight percent or more of rhenium, and about 0.1 weight percent or more of hafnium.

[c19] 19. The gas turbine engine component according to claim 12, wherein the superalloy consists of, by weight, 0.4% to 6.5% ruthenium, 4.5% to 5.75% rhenium, 5.8% to 10.7% tantalum, 4.25% to 17.0% cobalt, up to 0.05% hafnium, up to 0.06% carbon, up to 0.01% boron, up to 0.02% yttrium, 0.9% to 2.0% molybdenum, 1.25% to 6.0% chromium, up to 1.0% niobium, 5.0% to 6.6% aluminum, up to 1.0% titanium, 3.0% to 7.5% tungsten, and wherein the sum of molybdenum plus chromium plus niobium is 2.15% to 9.0%, and wherein the sum of aluminum plus titanium plus tungsten is 8.0% to 15.1%, the balance nickel and incidental impurities.